(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 768 843 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
24.02.1999 Bulletin 1999/08

(21) Application number: **93918043.6**

(22) Date of filing: **18.08.1993**

(51) Int. Cl.[6]: **A61B 17/60**, A61F 2/44, A61B 17/58, A61B 17/84

(86) International application number:
PCT/GB93/01746

(87) International publication number:
WO 94/04088 (03.03.1994 Gazette 1994/06)

(54) SURGICAL IMPLANTS

CHIRURGISCHE IMPLANTATE

IMPLANTS CHIRURGICAUX

(84) Designated Contracting States:
DE ES FR IT

(30) Priority: **19.08.1992 GB 9217578**

(43) Date of publication of application:
23.04.1997 Bulletin 1997/17

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EP 0 768 843 B1

Printed by Xerox (UK) Business Services
2.16.7/3.6

Description

[0001] This invention relates to surgical implants, etc., more particularly - but not exclusively - for the stabilization of the spine, but also applicable to other indications, such as the replacement or augmentation of knee or ankle ligaments, and also possibly applicable to the reduction of fractured bones.

[0002] Various forms of spinal stabilization are in use, including fixation devices such as Harrington, Hartshill (see EP-A-0 146 347 and EP-A-0 269 268 both of Surgicraft Limited), Luque, and Knodt, which comprise solid rods hooked on to the vertebrae or held thereto by wires.

[0003] More recently there have been introduced flexible stabilisation systems, such as inextensible strips between pedicle screws (see Burton US-A-4 743 260 and F.H.Breard and H.Graf EP-A-0 381 588) or inextensible bands of predetermined lengths round pedicle screws (see also EP-A-0 381 588).

[0004] Document EP-A-0 381 588 discloses in Figure 2 a surgical implant comprising a strand of flexible biocompatible material with a bight at each end and a pair of pedicle screws each having a portion for screwing into one part of the spinal column, integrated with a portion engageable with one of the brights.

[0005] However, in order to avoid failure of these anchorages in pedicles it has been proposed (in EP-A-0 381 588) to loop inextensible flexible members directly round the spinous processes; Senegas has an inextensible member wound in a figure of eight or multiples thereof round the spinous processes and through spacers therebetween (cf. also FR-A-2 623 085), while EP-A-0 322 334 of COTE S.A.R.L. (granted to CREMASCOLI FRANCE) has semi-elastic flat lacing looped round the spinous processes and in between passed through small tubular cushions of the same material.

[0006] The winding or looping of flexible members, whether inextensible or semi-elastic, round the spinous processes and through spacers or cushions is a time-consuming operation, and it is also difficult to tension the flexible members to adjust the load between vertebrae spanned by tile flexible members, because of friction of the flexible members with themselves and with the bones and spacers or cushions.

[0007] One object of the present invention is to provide a surgical implant that can be quickly and surely applied, particularly for spinal stabilization, and that can be easily tensioned to adjust the load between vertebrae spanned.

[0008] A secondary object of the invention is to adapt the surgical implant for alternative methods of engagement with the spine or with other bones in the body.

[0009] According to one aspect of the present invention, a surgical implant comprises a hank formed from a single strand of flexible biocompatible material with at least one bight at each end of the hank and a tail extending from at least one end, at least one ductile crimpable sleeve-like element encircling at least the overlapping end lengths of the strand, and a pair of hooking members, each having a broad flat hook portion for engaging one part of the spinal column, integrated with an oppositely directed and reverse facing round hook portion engageable with the bight or bights at one end of the hank.

[0010] Any slack in the hank can be taken up by pulling the tail, further pulling of which makes use of the purchase of the looped strand material to adjust the load between the vertebrae, then the crimpable sleeve-like element is squeezed (using any suitable, e.g., proprietary crimping tool) on to the lengths of strand passing therethrough to secure the strand in its tensioned state.

[0011] According to another aspect of the invention, a surgical implant comprises two hanks each formed from a single strand of flexible biocompatible material with at least one bight at each end of the hank and a tail extending from at least one end, two ductile crimpable sleeve-like elements each encircling at least the overlapping end lengths of the strand of one of the hanks, and two hooking members, each in the form of a broad flat yoke for engaging one part of the spinal column, with a round hook portion integrated with and oppositely directed to each end of the yoke and engageable with bights of the two hanks.

[0012] According to a further aspect of the invention, a surgical implant comprises two hanks each formed from a single strand of flexible biocompatible material with at least one bight at each end of the hank and a tail extending from at least one end, two ductile crimpable sleeve-like elements each encircling at least the overlapping end lengths of the strand of one of the hanks, one hooking member in the form of a broad flat yoke for engaging one part of the spinal column, with a round hook portion integrated with and oppositely directed to each end of the yoke and engageable with bights of the two hanks, and a pair of hooking members each having a broad flat hook portion for engaging another part of the spinal column, integrated with an oppositely directed and reverse facing round hook portion engageable with the bight or bights at the other end of one of the hanks.

[0013] Conveniently, the at least one bight at one end of the or each hank comprises an eye formed at the end of the strand material remote from the tail, while the at least one bight at the other end of the hank is formed by the strand material looping from the corresponding end of the crimpable sleeve-like element.

[0014] At least one of the hooking members preferably has abutment means for a tensioning tool for pulling the tail of the strand material, which abutment means may take the form of a hole located between the flat and round hook portions.

[0015] Each round hook portion is preferably formed by a bollard having a cylindrical body and a flat circular head, which aids retention of an eye at one end of the

strand material. The bollard is also conveniently engageable by a forked end of an applicator tool having a striking portion at the other end; and the flat circular head of the bollard may also serve as a spigot for engagement by a socket in a tensioning tool.

[0016] A selection of hooking members is preferably made available with a variety of widths and radii of the broad flat hook portions and/or of the yoke portion, so that the surgeon can select hooking members appropriate to the size and shape of parts of the spinal column.

[0017] The hooking members, when used on the spine, may be attached to the cranial or caudal border of the lamina, the cranial base of the transverse processes, or the caudal edge of the sacral foramen.

[0018] The insides of the broad flat hook portions and/or of the broad flat yokes are preferably provided with sharp-ridged ribs extending in the direction of application of the hooking members, to enhance the grip on engaged bone parts; and a leading end of each broad flat hook portion is preferably provided with a chisel edge, to effect some shaving of an engaged bone part, if necessary, to achieve a good fit.

[0019] The strand material may be made of polyester or any other suitably strong flexible inert or biocompatible material, and the crimpable sleeve-like element may be made from any suitably ductile inert material.

[0020] The inside of the crimpable sleeve-like element is preferably provided with circumferentially extending ribs, to enhance the grip on the strand material; thus, this element may be conveniently manufactured as an initially cylindrical and, preferably, internally screw-threaded sleeve, which is then flattened slightly, so as to accommodate a pair of overlapping end lengths of strand material in an element having minimal cross-sectional dimensions.

[0021] The hooking members may be made from any suitable implant material (e.g., stainless steel, titanium, ceramic) and may be coated with hydroxyapatite to encourage ingrowth of bone tissue, which will assist in reducing edge loading, while a plurality of turns of strand material in the hank will encourage ingrowth of body tissue.

[0022] Embodiments of the invention and manner of application thereof will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a plan view of some components of a surgical implant in accordance with the invention but shown applied in a manner known per se to the spinous processes of adjacent vertebrae;

Figure 2 is a side elevation of parts of Figure 1, as seen from the lower side of Figure 1;

Figure 3 corresponds to Figure 1 but shows two sets of similar components also applied in a manner known per se to pairs of pedicle screws secured in both sides of a pair of adjacent vertebrae;

Figure 4 is a side elevation of one of the implants of Figure 3 and its associated pedicle screws, with an indication (in chain-dotted lines) of the pair of adjacent vertebrae, and with an indication how further similar implants can extend from those pedicle screws;

Figure 5 is a perspective view of a basic concept for a surgical implant in accordance with the invention provided with hooking members, one of which is engaged by a tensioning tool;

Figure 6 is a fragmentary perspective view showing the crimpable sleeve-like element of Figure 5 after crimping on to the lengths of strand passing through it;

Figure 7 is a perspective view of alternative form of hooking member to those shown in Figure 5;

Figure 8 is a plan view of preferred forms of components for use in surgical implants in accordance with the invention:

Figure 9 is an end view of the crimpable sleeve-like element of Figure 8;

Figure 10 is an enlarged section taken from the line X-X of Figure 9;

Figure 11 is a plan view showing the two sets of components as in Figures 8 to 10, together with a preferred form of yoke and a pair of other hooking members of preferred form applied to adjacent vertebrae;

Figure 12 is a side elevation of parts of Figure 11, with an indication of similar surgical implants, yoke and other hooking members extending from one of the vertebrae to the next;

Figures 13 (a), (b), (c) and (d) are respective plan, side, underneath and end views of one of the hooking members shown in Figures 11 and 12;

Figure 14 is a side elevation of a tool for use in driving into place a hooking member as in Figures 13 (a) to (d) and shown engaged therewith;

Figure 15 is a fragmentary underneath view of the lower end of the tool of Figure 14, without the hooking member;

Figures 16 (a), (b), (c) and (d) are respective plan, side, underneath and end views of the other hooking member shown in Figures 11 and 12;

Figure 17 is a side elevation of a tensioning tool for engagement with one of the hooking members shown in Figures 11 and 12; and

Figure 18 is an underneath view of the tensioning tool shown in Figure 17.

[0023] In Figures 1 and 2, which do not constitute part of the claimed invention, a hank 20 formed from a single strand 21 of flexible biocompatible material with bights 22 at both ends, is shown applied, in a manner known per se, over each of two spinous processes 23 on adjacent vertebrae 24 with tails 25 projecting from a crimpable sleeve-like element 26 encircling the overlapping end lengths 27 of the strand, the element 26 being shown as having been crimped to secure the strand 21 after tensioning by pulling the tails 25 in opposite directions.

[0024] In Figure 3, two similar hanks 20 are shown applied, also in a manner known per se, to pairs of pedicle screws 28 secured in both sides of a pair of adjacent vertebrae 24, the crimpable sleeve-like elements 26 being shown as having been crimped after tensioning the strands 21 to provide symmetrical loading of the vertebrae. In Figure 4, strands 21X, 21Y of further implants 20X, 20Y are indicated as extending to further adjacent vertebrae which are not shown or indicated.

[0025] In Figure 5, which illustrates a basic concept of the invention, the strand 21 has one bight at one end of the hank (20) comprising an eye 29 formed at the end of the strand material remote from the tail 25, and the hank consists of a plurality of loops with all the lengths of strand between the bights 22 encircled by the crimpable sleeve-like element 26. Hooking members 30 each have a broad flat hook portion 31 for engaging one part of the spinal columnm, e.g., the lamina or transverse processes (not shown) on one side of the spine and to distribute the load over a greater edge area thereof, and an oppositely directed and reverse facing round hook portion 32 engaged by the bights 22 at one end of the hank of flexible biocompatible material 21. Abutment means for a tensioning tool 33, for pulling the tail 25 of the strand material, takes the form of a hole 34 located between the flat and round hook portions 31, 32, which hole is engaged by a spigot 35 at one end of a shank 36 of the tensioning tool. This tool 33 is in the form of a capstan with handgrip means 37 at the other end of the shank for rotating the capstan, a cleat 38 being provided on one side of the shank for securing the tail 25 of the strand material 21 to the shank for winding thereon upon rotation of the capstan. Figure 6 shows the crimpable sleeve-like element 26 crimped on to the hank.

[0026] Figure 7 shows a hooking member 39 having a broad flat yoke 40 with a round hook portion 32 integrated with and oppositely directed to each end of the yoke. Two such hooking members may have their yokes hooked on to spinous processes (not shown) of adjacent vertebrae, and two hanks and two crimpable sleeve-like elements combined therewith by hooking the bights 22 of the hanks on the round hook portions 32, with one hank on each side of the spinous processes, and the elements 26 crimped on to the hanks after they have been tensioned. Alternatively, one such hooking member 39 may have its yoke hooked on a spinous process of one vertebra while two hooking members 30 have their broad flat hook portions hooked on the lamina of an adjacent vertebra, and combined with two hanks and two crimpable sleeve-like elements by hooking the bights of the hanks on respective round hook portions on the hooking members 30, 39.

[0027] It will be appreciated that because the crimpable sleeve-like element 26 in Figures 5 and 6 encircles four lengths of the strand material 21, its bore must be of an adequate diameter for easy feeding of the tail 25 repeatedly therethrough, and - in consequence - the outside diameter will be commensurately larger. Preferably, therefore, as shown in Figures 1 and 2, Figures 3 and 4, and Figures 11 and 12, the crimpable sleeve-like element 26 encircles only the overlapping end lengths 27 of the strand 21, thus minimising the cross-sectional dimensions of the element 26. Thus the element 26 may be manufactured as an initially cylindrical and, preferably, internally screwthreaded sleeve, which is then flattened slightly to give the preferred form shown in Figures 8 to 10 with the turns of the internal screwthread 41 constituting circumferentially extending ribs, to enhance the grip on the strand material 21 upon crimping of the element 26 thereon.

[0028] The preferred forms of crimpable sleeve-like element 26 and strand material 21 with eye 29 are shown in Figures 11 and 12 in use in combination with preferred forms of hooking members, details of which will be described with reference to Figures 13(a) to (d) and 16(a) to (d). In these preferred forms of hooking members the round hook portions 32 are formed by bollards having cylindrical bodies 42 and flat circular heads 43, and the heads on the hooking members 30 are shown in Figures 11 and 12 aiding retention of the eyes 29 of hanks of strand material hooked on the bollards.

[0029] In Figure 14 the bollard 32 of one of the hooking members 30 is shown engaged by a forked end 44 of an applicator tool 45 having a striking portion 46 at the other end, which enables the hooking member 30 to be hammered into place on the lamina 47 at one side of the spinous process 23 of one vertebra 24, and - as shown in Figure 11 - another hooking member 30 is hammered into place on the lamina 47 at the other side of that spinous process 23. As can be seen in Figures 13(a) to (d), the inside of each broad flat hook portion 31 is provided with a sharp-ridged rib 48 extending in the direction of application of the hooking member 30, to enhance the grip on the engaged bone part. A leading end 49 of each broad flat hook portion 31 is provided with a chisel edge, to effect some shaving of the engaged bone part, if necessary, to achieve a good fit.

[0030] In Figures 16(a) to (d) a hooking member 39

can be seen to be provided with sharp-ridged ribs 50 extending along the insides of the arms of the yoke portion 40 in the direction of application to the spinous process 23 of an adjacent vertebra 24 in Figures 11 and 12, to enhance the grip on this engaged bone part.

[0031] Referring again to Figures 11 and 12 the bights 22 of tile hanks are applied to respective bollard type round hook portions on the yoke 39, 40, with the crimpable sleeve-like elements 26 encircling the overlapping end lengths 27 of the strands, and after tensioning of the strands (as by means of the tool shown in Figures 17 and 18, and which will be described presently) the elements 26 are crimped on to the lengths of strand passing therethrough to secure the strands in their tensioned state.

[0032] Any suitable one of the heads 43 of the bollard type round hook portions of the hooking members 30, 39 may serve as a spigot engageable by a socket 51 in one end of the tensioning tool 52 shown in Figures 17 and 18, the other end of which has a handgrip 53 enabling the tool to be rotated with the socket 51 thus engaged with a head 43. The tool 52 has a notch 54 into which the tail 25 of a hank can be jammed, and a neck 55 round which the strand material 21 can be wound as the tool is rotated to tension the strand material.

[0033] Further hooking members 30X, 39X, a hank of strand material 21X and crimped element 26X are indicated in chain dotted lines Figure 12 providing further stabilisation between the vertebra carrying the hooking member 39 and the next adjacent vertebra.

Claims

1. A surgical implant comprising a hank (20) formed from a single strand (21) of flexible biocompatible material with at least one bight (22) at each end of the hank and a tail (25) extending from at least one end, at least one ductile crimpable sleeve-like element (26) encircling at least the overlapping end lengths (27) of the strand, and a pair of hooking members (30), each having a broad flat hook portion (31) for engaging one part of the spinal column, integrated with an oppositely directed and reverse facing round hook portion (32) engageable with the bight or bights (22) at one end of the hank.

2. A surgical implant comprising two hanks (20) each formed from a single strand (21) of flexible biocompatible material with at least one bight (22) at each end of the hank and a tail (25) extending from at least one end, two ductile crimpable sleeve-like elements (26) each encircling at least the overlapping end lengths (27) of the strand of one of the hanks, and two hooking members (39), each in the form of a broad flat yoke (40) for engaging one part of the spinal column, with a round hook portion (32) integrated with and oppositely directed to each end of the yoke and engageable with bights of the two hanks.

3. A surgical implant comprising two hanks (20) each formed from a single strand (21) of flexible biocompatible material with at least one bight (22) at each end of the hank and a tail (25) extending from at least one end, two ductile crimpable sleeve-like elements (26) each encircling at least the overlapping end lengths (27) of the strand of one of the hanks, one hooking member (39) in the form of a broad flat yoke (40) for engaging one part of the spinal column, with a round hook portion (32) integrated with and oppositely directed to each end of the yoke and engageable with bights of the two hanks, and a pair of hooking members (30) each having a broad flat hook portion (31) for engaging another part of the spinal column, integrated with an oppositely directed and reverse facing round hook portion (32) engageable with the bight or bights (22) at the other end of one of the hanks.

4. A surgical implant as in any one of Claims 1 to 3, characterized in that the at least one bight (22) at one end of the or each hank comprises an eye (29) formed at the end of the strand material (21) remote from the tail (25), while the at least one bight (22) at the other end of the hank is formed by the strand material (21) looping from the corresponding end of the ductile crimpable sleeve-like element.

5. A surgical implant as in any one of Claims 1 to 4 , characterized in that at least one of the hooking members (30) has abutment means (34) for a tensioning tool (33) for pulling the tail (25) of the strand material (21).

6. A surgical implant as in Claim 5, characterized in that the abutment means (34) takes the form of a hole located between the flat and round hook portions (31, 32).

7. A surgical implant as in any one of Claims 1 to 6, characterized in that each round hook portion (32) is formed by a bollard having a cylindrical body (42) and a flat circular head (43).

8. A surgical implant as in any one of Claims 1 to 7, characterized in that a selection of hooking members (30, 39) is made available with a variety of widths and radii of the broad flat hook portions (31) and/or of the yoke portion (40).

9. A surgical implant as in any one of Claims 1 to 8, characterized in that the insides of the broad flat hook portions (31) and/or of the broad flat yokes (40) are provided with sharp-ridged ribs (50) extending in the direction of application of the hooking members, to enhance the grip on engaged bone

parts.

10. A surgical implant as in Claim 1 or Claim 3, characterized in that a leading end (49) of each broad flat hook portion (31) is provided with a chisel edge, to effect some shaving of an engaged bone part.

11. A surgical implant as in ally one of Claims 1 to 10, characterized in that the strand material (21) is made of polyester.

12. A surgical implant as in any one of Claims 1 to 11, characterized in that the inside of the ductile crimpable sleeve-like element (26) is provided with circumferentially extending ribs (41), to enhance the grip on the strand material (21).

13. A surgical implant as in Claim 12, characterized in that the ductile crimpable sleeve-like element (26) is manufactured as an initial cylindrical and internally screwthreaded sleeve, which is then flattened slightly, so as to accommodate a pair of overlapping end lengths (27) of strand material (21) in an element having minimal cross-sectional dimensions.

14. A surgical implant as in any one of Claims 1 to 13, characterized in that the hooking members (30, 39) are coated with hydroxyapatite to encourage ingrowth of bone tissue.

Patentansprüche

1. Chirurgisches Implantat, umfassend einen Strang (20) gebildet aus einem einzelnen Faden (21) aus biegsamem, biokompatiblen Material, mit mindestens einer Krümmung (22) an jedem Ende des Stranges und einem Schwanz (25), der sich von mindestens einem Ende wegerstreckt, mindestens ein verformbares, falt- bzw. zusammendrückbares, hülsenähnliches Element (26), welches zumindest die überlappenden Endabschnitte (27) des Fadens umgibt, und ein Paar Hakenelemente (30), von denen jedes einen breiten, flachen Hakenabschnitt (31) für den Eingriff in einen Teil der Wirbelsäule umfaßt, integral ausgebildet mit einem entgegengesetzt gerichteten und verkehrt gewendeten runden Hakenabschnitt (32), der in die Krümmung oder die Krümmungen (22) an einem Ende des Stranges eingreifen kann.

2. Chirurgisches Implantat, umfassend zwei Stränge (20), von denen jeder aus einem einzelnen Faden (21) aus biegsamem, biokompatiblen Material gebildet ist, mit mindestens einer Krümmung (22) an jedem Ende des Stranges und einem Schwanz (25), der sich von mindestens einem Ende wegerstreckt, zwei verformbare, falt- bzw. zusammendrückbare, hülsenähnliche Elemente (26), von denen jedes zumindest die überlappenden Endabschnitte (27) des Fadens eines der Stränge umgibt, und zwei Hakenelemente (39), von denen jedes die Form eines breiten, flachen Bügels (40) für den Eingriff in einen Teil der Wirbelsäule aufweist, wobei ein runder Hakenabschnitt (32) integral an jedem Ende des Bügels vorhanden und entgegengesetzt dazu ausgerichtet ist und in Krümmungen der zwei Stränge eingreifen kann.

3. Chirurgisches Implantat, umfassend zwei Stränge (20), von denen jeder aus einem einzelnen Faden (21) aus biegsamem, biokompatiblen Material gebildet ist, mit mindestens einer Krümmung (22) an jedem Ende des Stranges und einem Schwanz (25), der sich von mindestens einem Ende wegerstreckt, zwei verformbare, falt- bzw. zusammendrückbare, hülsenähnliche Elemente (26), von denen jedes zumindest die überlappenden Endabschnitte (27) des Fadens eines der Stränge umgibt, ein Hakenelement (39) in der Form eines breiten, flachen Bügels (40) für den Eingriff in einen Teil der Wirbelsäule, wobei ein runder Hakenabschnitt (32) integral an jedem Ende des Bügels vorhanden und entgegengesetzt dazu ausgerichtet ist und in Krümmungen der zwei Stränge eingreifen kann, und ein Paar Hakenelemente (30), von denen jedes einen breiten, flachen Hakenabschnitt (31) für den Eingriff in einen anderen Teil der Wirbelsäule aufweist, integral ausgebildet mit einem entgegengesetzt gerichteten und verkehrt gewendeten runden Hakenabschnitt (32), der in die Krümmung oder die Krümmungen (22) am anderen Ende eines der Stränge eingreifen kann.

4. Chirurgisches Implantat nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die mindestens eine Krümmung (22) an einem Ende des Stranges oder eines jeden Stranges eine Öse (29) umfaßt, die am Ende des Fadenmaterials (21) entgegengesetzt vom Schwanz (25) ausgebildet ist, während die mindestens eine Krümmung (22) am anderen Ende des Stranges vom Fadenmaterial (21) gebildet wird, das eine Schleife vom entsprechenden Ende des verformbaren, falt- bzw. zusammendrückbaren, hülsenähnlichen Elementes bildet.

5. Chirurgisches Implantat nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß mindestens eines der Hakenelemente (30) ein Verankerungsmittel (34) für ein Spannungswerkzeug (33) besitzt, um am Schwanz (25) des Fadenmaterials (21) zu ziehen.

6. Chirurgisches Implantat nach Anspruch 5, dadurch gekennzeichnet, daß das Verankerungsmittel (34) die Form eines Loches aufweist, das sich zwischen dem flachen und dem runden Hakenabschnitt (31,

32) befindet.

7. Chirurgisches Implantat nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß jeder runde Hakenabschnitt (32) von einem Poller mit einem zylinderförmigen Körper (42) und einem flachen, kreisförmigen Kopf (43) gebildet wird.

8. Chirurgisches Implantat nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß eine Auswahl der Hakenelemente (30, 39) mit einer Vielzahl unterschiedlicher Breiten und Radien der breiten flachen Hakenabschnitte (31) und/oder des Bügelabschnittes (40) zur Verfügung steht.

9. Chirurgisches Implantat nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Innenseiten der breiten, flachen Hakenabschnitte (31) und/oder der breiten, flachen Bügel (40) mit scharfkantigen Rippen (50) versehen sind, die sich in die Richtung der Anwendung der Hakenelemente erstrecken, um den Halt an den in Eingriff gebrachten Knochenteilen zu verbessern.

10. Chirurgisches Implantat nach Anspruch 1 oder Anspruch 3, dadurch gekennzeichnet, daß ein führendes Ende (49) eines jeden breiten, flachen Hakenabschnittes (31) mit einer Meißelkante ausgestattet ist, um ein gewisses Abschälen eines in Eingriff stehenden Knochenteiles zu bewirken.

11. Chirurgisches Implantat nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß das Fadenmaterial (21) aus Polyester hergestellt ist.

12. Chirurgisches Implantat nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß die Innenseite des verformbaren, falt- bzw. zusammendrückbaren, hülsenähnlichen Elementes (26) mit sich umfänglich erstreckenden Rippen (41) ausgestattet ist, um den Halt am Fadenmaterial (21) zu verbessern.

13. Chirurgisches Implantat nach Anspruch 12, dadurch gekennzeichnet, daß das verformbare, falt- bzw. zusammendrückbare, hülsenähnliche Element (26) als anfänglich zylinderförmige und innen mit Schraubengewinde versehene Hülse hergestellt wird, die danach leicht abgeflacht wird, um ein Paar überlappender Endabschnitte (27) des Fadenmaterials (21) in einem Element mit minimalen Querschnittsabmessungen aufzunehmen.

14. Chirurgisches Implantat nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß die Hakenelemente (30, 39) mit Hydroxylapatit beschichtet sind, um das Einwachsen von Knochengewebe zu fördern.

Revendications

1. Implant chirurgical comprenant une cordelette (20) constituée à partir d'une torsade unique (21) en matériau biocompatible flexible et comportant au moins une anse (22) à chaque extrémité de la cordelette et une queue (25) s'étendant depuis au moins une extrémité, au moins un élément ductile sertissable en forme de manchon (26) encerclant au moins les longueurs d'extrémité (27) de la torsade se chevauchant, et une paire d'éléments d'accrochage (30), présentant chacun une partie formant crochet (31) large et plate destinée à s'engager sur une partie de la colonne vertébrale, ne formant qu'une seule pièce avec une partie formant crochet (32) ronde, orientée de façon inverse et à l'opposé, susceptible de coopérer avec l'anse ou les anses (22) à une extrémité de la cordelette.

2. Implant chirurgical comprenant deux cordelettes (20), constituées, chacune, à partir d'une cordelette unique (21) en matériau biocompatible flexible et comportant au moins une anse (22) à chaque extrémité de la cordelette et une queue (25) s'étendant depuis au moins une extrémité, deux éléments ductiles sertissables en forme de manchons (26) encerclant chacun au moins les longueurs d'extrémité (27), se chevauchant, de la torsade de l'une des cordelettes, et deux éléments d'accrochage (39), se présentant chacun sous la forme d'un étrier (40) plat et large destiné à s'engager sur une partie de la colonne vertébrale, avec une partie formant crochet (32) ronde, orientée à l'opposé de chaque extrémité de l'étrier, et ne formant qu'une seule pièce avec elle, et susceptible de coopérer avec des anses des deux cordelettes.

3. Implant chirurgical comprenant deux cordelettes (20), constituées, chacune, à partir d'une cordelette unique (21) en matériau biocompatible flexible et comportant au moins une anse (22) à chaque extrémité de la cordelette et une queue (25) s'étendant depuis au moins une extrémité, deux éléments ductiles sertissables en forme de manchons (26) encerclant chacun au moins les longueurs d' extrémité (27), se chevauchant, de la torsade de l'une des cordelettes, un élément d'accrochage (39), se présentant sous la forme d'un étrier (40) plat et large destiné à s'engager sur une partie de la colonne vertébrale, avec une partie formant crochet (32) ronde, orientée à l'opposé de chaque extrémité de l'étrier, et ne formant qu'une seule pièce avec elle, et susceptible de coopérer avec des anses des deux cordelettes, et une paire d'éléments d'accrochage (30), présentant chacun une partie formant crochet (31) large et plate destinée à s'engager sur une autre partie de la colonne vertébrale, ne formant qu'une seule pièce avec une partie formant

crochet (32) ronde, orientée de façon inverse et à l'opposé, susceptible de coopérer avec l'anse ou les anses (22) à l'autre extrémité de l'une des cordelettes.

4. Implant chirurgical selon l'une quelconque des revendications 1 à 3, caractérisé en ce que l'anse (22), au nombre d'au moins une, à une extrémité de la cordelette ou de chaque cordelette, comprend un oeillet (29) formé à l'extrémité de la torsade (21) qui est éloignée de la queue (25), tandis que l'anse (22), au nombre d'au moins une, à l'autre extrémité de la cordelette, est constituée par le matériau de la torsade (21) qui forme une boucle à partir de l'extrémité correspondante de l'élément ductile et sertissable en forme de manchon.

5. Implant chirurgical selon l'une quelconque des revendications 1 à 4, caractérisé en ce qu'au moins l'un des éléments d'accrochage (30) comporte des moyens de butée (34) destinés à un outil de mise sous tension (33) servant à tirer sur la queue (25) de la torsade (21).

6. Implant chirurgical selon la revendication 5, caractérisé en ce que les moyens de butée (34) se présentent sous la forme d'un perçage ménagé entre les parties formant crochet plates et rondes (31, 32).

7. Implant chirurgical selon l'une quelconque des revendications 1 à 6, caractérisé en ce que chaque partie formant crochet ronde (32) est formée d'un plot possédant un corps cylindrique (42) et une tête circulaire plate (43).

8. Implant chirurgical selon l'une quelconque des revendications 1 à 7, caractérisé en ce qu'une sélection d'éléments d'accrochage (30, 39) est mise à disposition dans une variété de largeurs et de rayons des parties formant crochets (31) larges et plates et/ou de la partie formant étrier (40).

9. Implant chirurgical selon l'une quelconque des revendications 1 à 8, caractérisé en ce que les faces intérieures des parties formant crochets (31) larges et plates et/ou des étriers (40) larges et plats sont pourvues de nervures à arêtes vives (50) s'étendant dans la direction d'application des éléments d'accrochage, afin d'améliorer la prise sur les parties d'os sur lesquelles ils s'appliquent.

10. Implant chirurgical selon la revendication 1 ou la revendication 3, caractérisé en ce qu'une extrémité avant (49) de chaque partie d'accrochage (31) large et plate est équipée d'un bord tranchant, afin de racler une partie d'os sur laquelle elle s'applique.

11. Implant chirurgical selon l'une quelconque des revendications 1 à 10, caractérisé en ce que le matériau de la torsade (21) est du polyester.

12. Implant chirurgical selon l'une quelconque des revendications 1 à 11, caractérisé en ce que la face intérieure de l'élément ductile sertissable en forme de manchon (26) est pourvue de nervures (41), s'étendant sur la circonférence, afin d'améliorer la prise sur le matériau de la torsade (21).

13. Implant chirurgical selon la revendication 12, caractérisé en ce que l'élément ductile sertissable en forme de manchon (26) est fabriqué à partir d'un manchon originellement cylindrique et taraudé, qui est ensuite légèrement aplati, afin de contenir une paire de longueurs d'extrémité (27), se chevauchant, en matériau de la torsade (21), dans un élément présentant une section transversale minimum.

14. Implant chirurgical selon l'une quelconque des revendications 1 à 13, caractérisé en ce que les éléments d'accrochage (30, 39) sont revêtus d'hydroxy-apatite pour favoriser la croissance du tissu osseux.

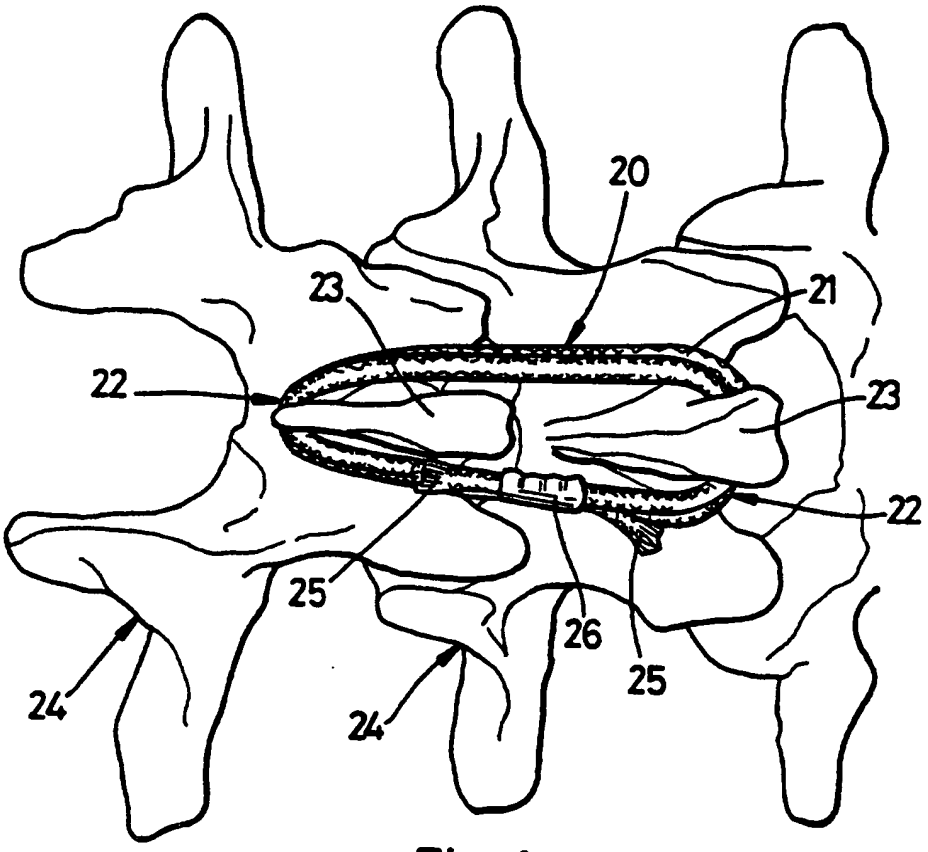

Fig. 1

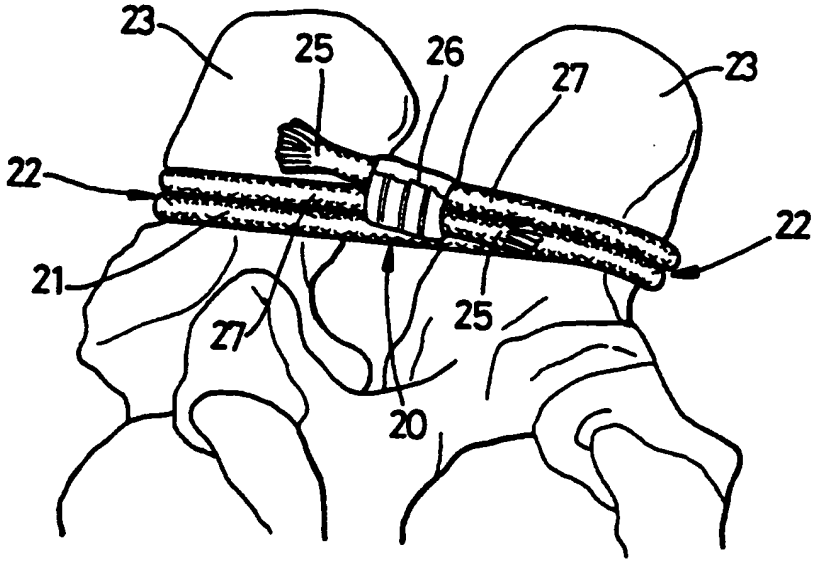

Fig. 2

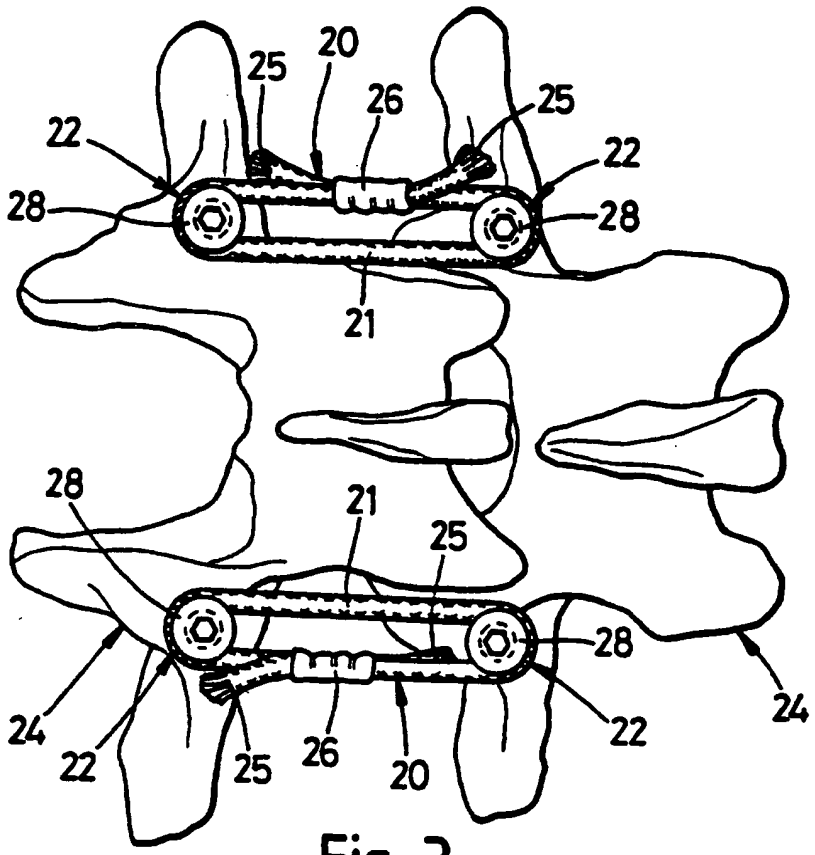
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Fig. 3

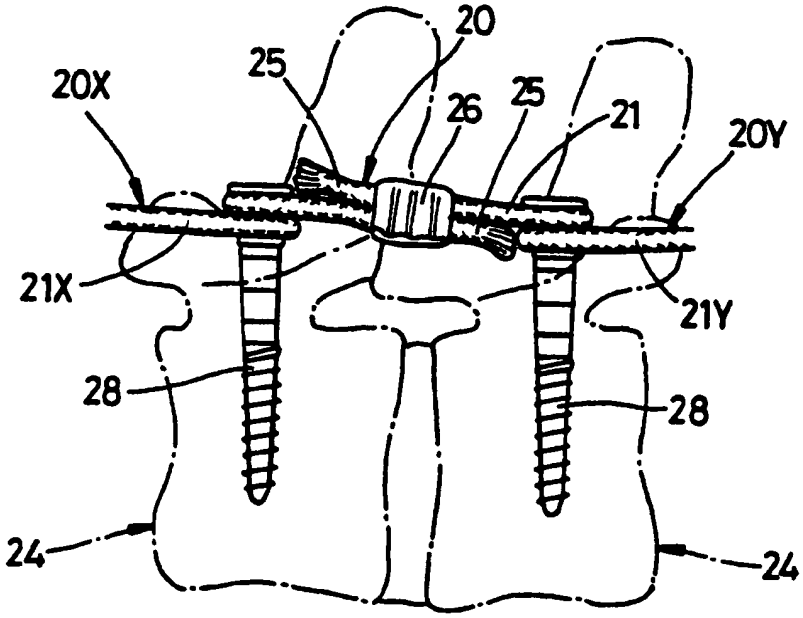
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Fig. 4

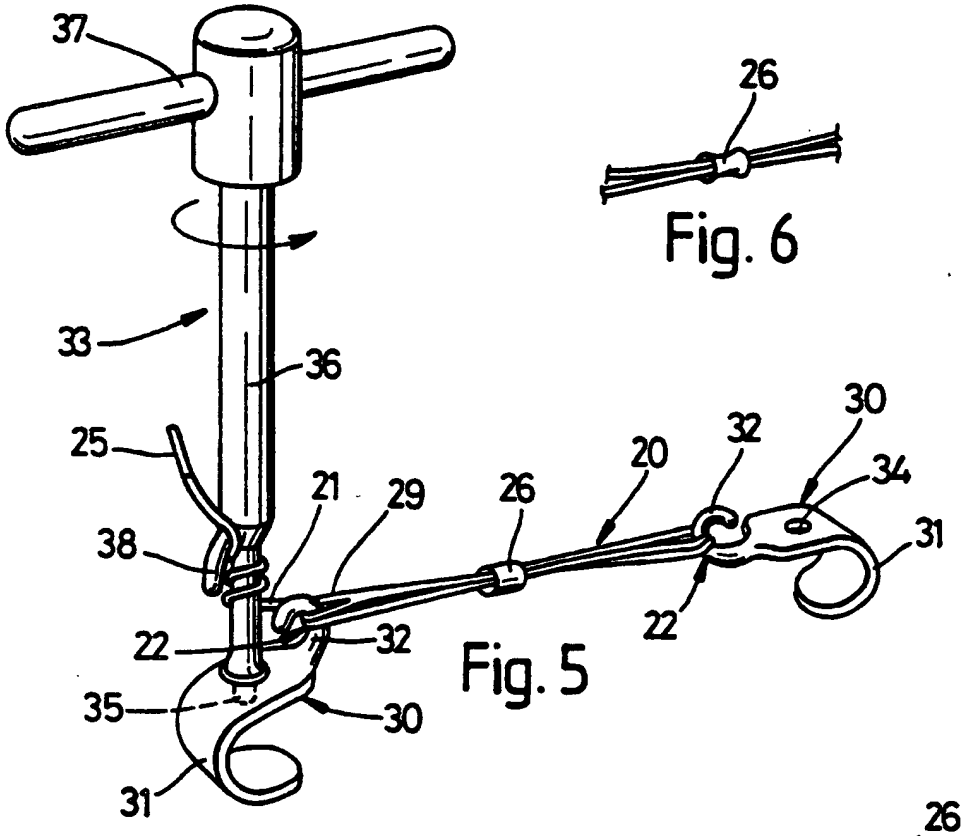

Fig. 5

Fig. 6

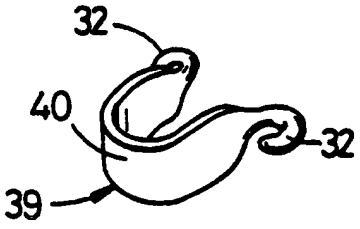

Fig. 7

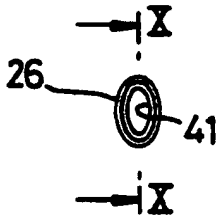

Fig. 9

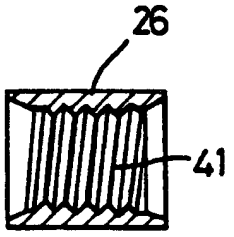

Fig. 10

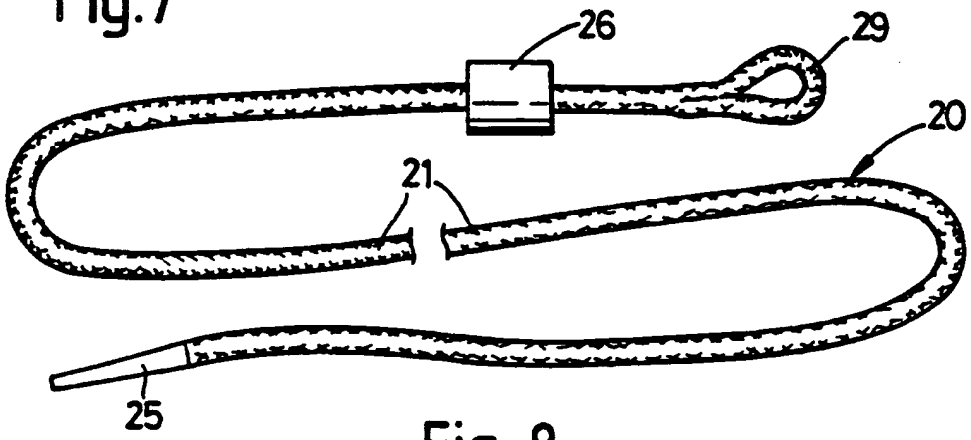

Fig. 8

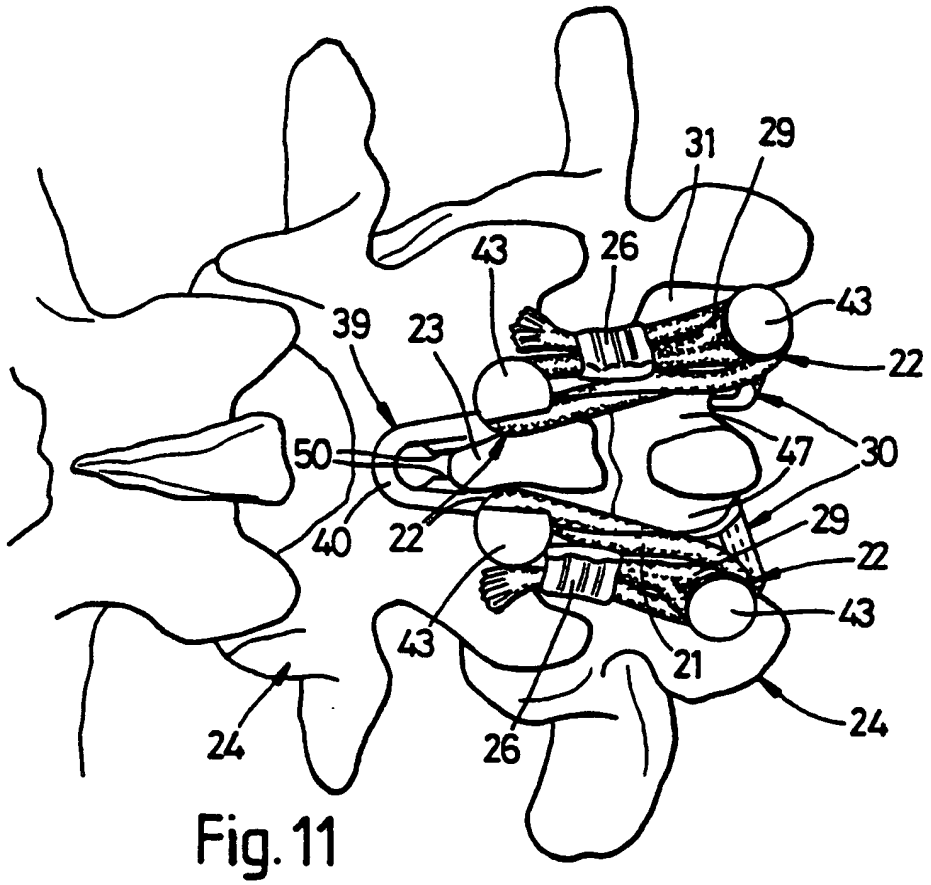
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Fig. 11

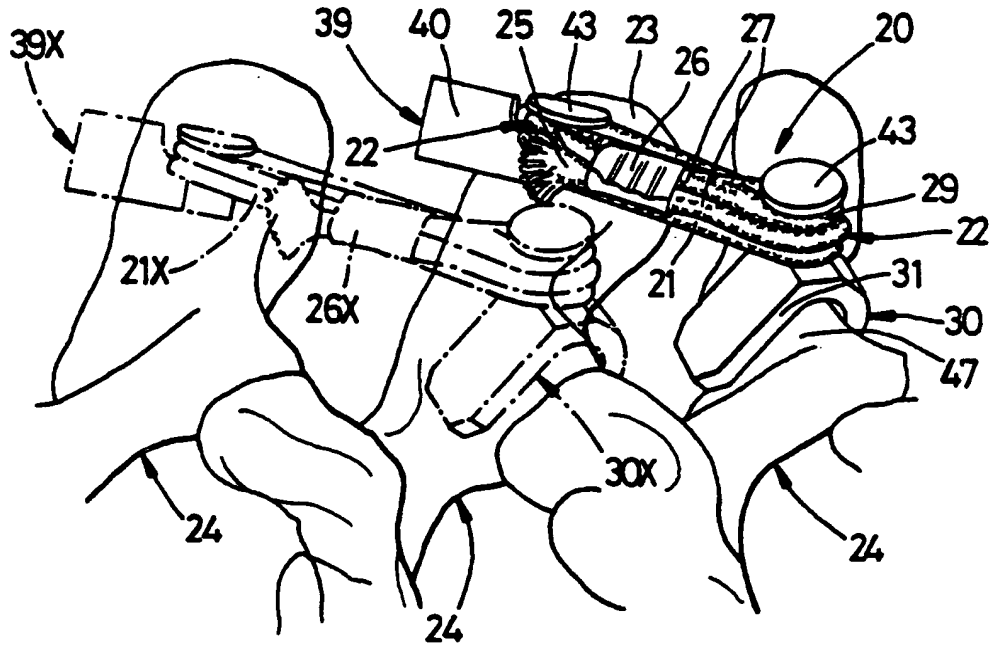
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Fig. 12

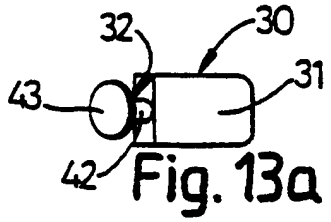

Fig. 13a

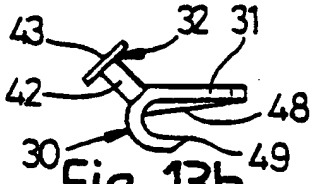

Fig. 13b

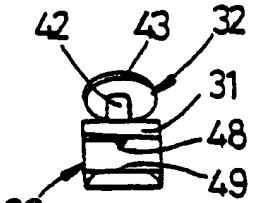

Fig. 13d

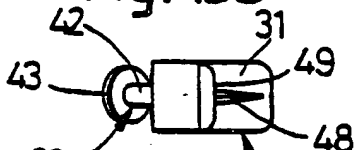

Fig. 13c

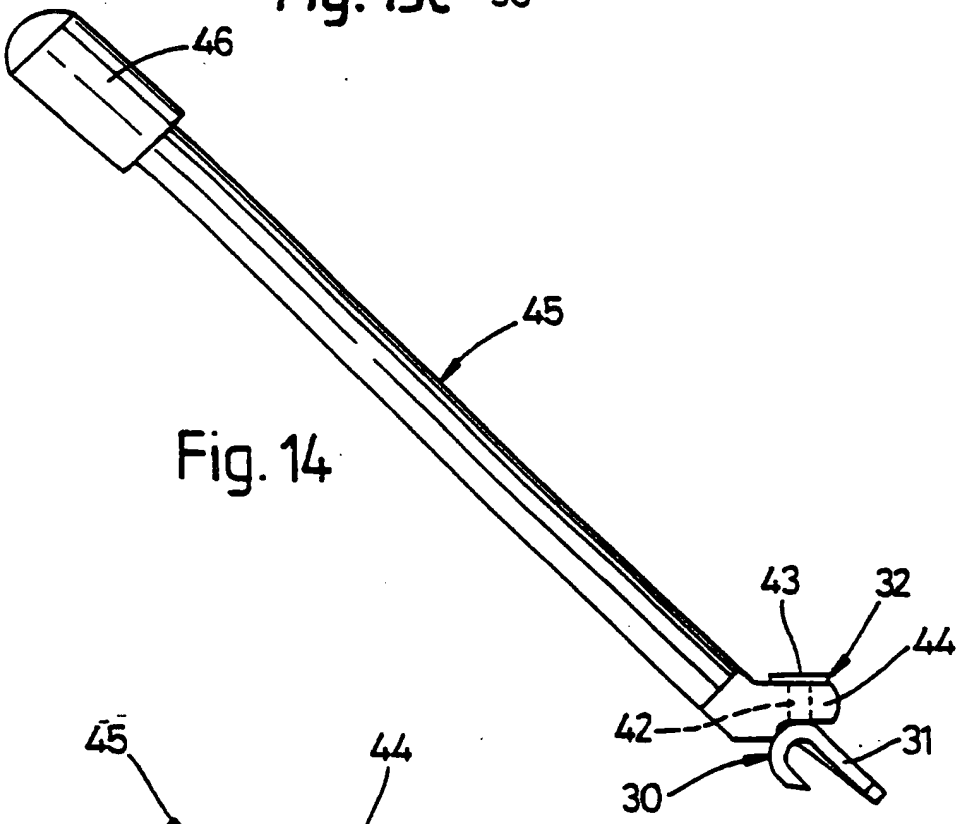

Fig. 14

Fig. 15

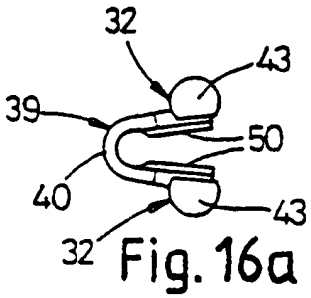

Fig. 16a

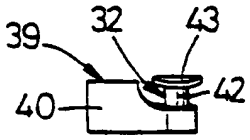

Fig. 16b

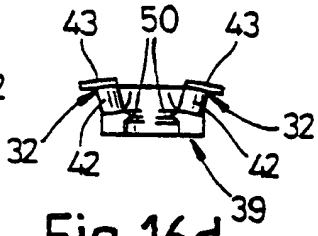

Fig. 16d

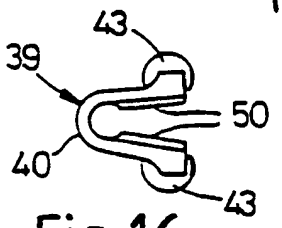

Fig. 16c

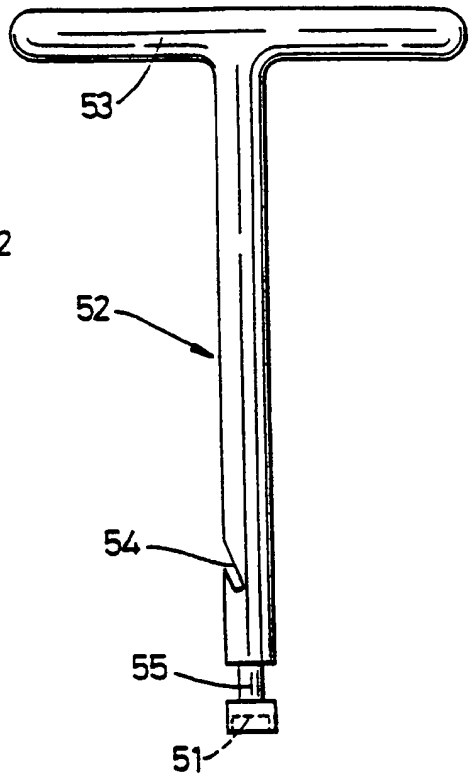

Fig. 17

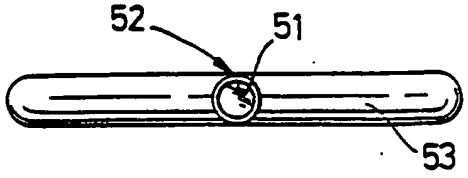

Fig. 18